

## Original Research

# Deterrence effect of penalties upon adolescent cannabis use

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### Abstract

**Objective:** Penalties are used in an effort to curtail drug use by citizens in most societies. There are growing calls for a reduction or elimination of such penalties. Deterrence theory suggests that use should increase if penalties reduce and vice versa. We sought to examine the relationship between changes to penalties for drug possession and adolescent cannabis use.

**Method:** Ten instances of penalty change occurred in Europe between 2000 and 2014, seven of which involved penalty reduction and three involved penalty increase. We conducted a secondary analysis of a series of cross-sectional surveys of 15–16-year-old school children, the ESPAD surveys, which are conducted every four years. We focused on past month cannabis use. We anticipated that an eight-year time span before and after each penalty change would yield two data points either side of the change. A simple trend line was fitted to the data points for each country.

**Results:** In eight cases, the trend slope in past month cannabis use was in the direction predicted by deterrence theory, the two exceptions being the UK policy changes. Using the principals of binomial distributions, the likelihood of this happening by chance is  $56/1024 = 0.05$ . The median change in the baseline prevalence rate was by 21%.

**Conclusions:** The science seems far from settled on this issue. There remains a distinct possibility that reducing penalties could contribute to small increases in adolescent cannabis use and consequently increase cannabis-related harms. This possibility should be considered in any political decision-making influencing drug policy changes.

**Keywords:** Cannabis; legislation; adolescence; deterrence

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### Introduction

Drug policy is facing very significant international scrutiny at present (Hall, 2018). The utility and proportionality of criminal sanctions to deter drug use is being challenged (Godlee & Hurley, 2016). It is argued that the severity of the penalty for drug use is not predictive of rates of use. This issue has been a source of debate also in Ireland in the past decade, an expert group recently advising that there should be a move away from criminal convictions and courts and towards health assessment referrals where people are found to be using drugs by An Garda Síochána (Department of Justice, 2019). Given that the current programme for government includes a proposed citizen's assembly on drug use, this topic is likely to be raised again in future discussions concerning amendments to the Misuse of Drugs Act in Ireland.

This policy issue was addressed in an editorial by Hughes et al. (2018) of the influential European Monitoring Centre for Drugs & Drug Addiction (EMCDDA). The authors explored the

relationship between changes in the severity of statutory penalties for drug use offences and cannabis use by young adults. Using prevalence data from a variety of national general population surveys, they examined patterns of past year cannabis use before and after the policy change. They considered the impact of modifications made to the penalty regimes in nine instances across seven countries during the period 2000–2014. Deterrence theory suggests that increasing penalties should cause a fall in use and decreasing penalties should cause use to increase (MacCoun et al. 2009; Pacula & Sevigny, 2014). Upon visual inspection of graphs depicting rates of use across time, they found no consistent association to support a deterrence effect. They highlighted a number of caveats and the various methodological limitations of the surveys. Nevertheless, they expressed their hope that their editorial would “encourage legislators to reduce their concern for the effect of the penalty size on use rates” (Hughes et al. 2018). In making such a strong conclusion, they appear to be indicating to politicians that this is settled science.

In the recent review of global drug policy undertaken by Babor et al. (2018), the conclusions on impact of sanctions were more nuanced. It was stated that “reducing sanctions can affect consumption, but it need not and . . . does not seem to produce very large effects.” That review discussed wider aspects of penalty

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administration beyond simple severity to include immediacy and certainty and emphasised the many challenges of analysing impacts of drug policy changes in real world situations. Such challenges are certainly not unique to assessment of drug policy amendments (Petticrew et al. 2017).

With regard to substance use and related policies, health professionals generally have elevated concerns regarding adolescents. Substance use constitutes the biggest single modifiable risk factor for morbidity globally among 15- to 24-year-olds (Gore et al. 2011). Cannabis dependence contributes more to morbidity among adolescents worldwide than that related to any other illicit drug (Degenhardt et al. 2013). Most adults with cannabis use disorders (CUD) commence cannabis use in adolescence, and early onset of use increases risk for later dependence (Millar et al. 2021; Volkow et al. 2014; Wilson et al. 2019). There has been an increase in the numbers of young people-seeking treatment for CUD in Ireland and across Europe (Smyth et al. 2019). Cannabis use at an early age is associated with increased likelihood of major mental disorders including psychosis (Di Forti et al. 2019; Murray & Hall, 2020). Many researchers have also highlighted the link between adolescent cannabis use and cognitive impairment (Morin et al. 2018; Murray et al. 2016; Volkow et al. 2014; Wilson et al. 2019). The trend across Europe in the past decade for higher potency cannabis adds to these concerns as this increases risks (Di Forti et al. 2019; EMCDDA, 2019; Wilson et al. 2019).

The general trend in past month cannabis use by 16-year-olds was quite static across Europe over the period 1999 to 2019, varying between 6 and 8%, peaking in 2003 (ESPAD Group, 2020). It did rise from a low base of 4% in 1995. However, within individual countries there were substantial fluctuations in the prevalence of past month use over this period. Rates of cannabis use are substantially higher in USA, where past month use by 10<sup>th</sup> grade students over this period has been two to three times higher than that in Europe (ESPAD Group, 2020; Miech et al. 2019).

When contemplating the liberalisation of cannabis policy in North America, Colizzi and Murray (2018) urged caution regarding legislative change and advised that it seems best to observe how harms change there before embarking down the same path. They stated that “the USA and Canada have embarked on a major pharmaceutical experiment with the brains of their youth.” The caution urged by Colizzi and Murray (2018) and the nuanced conclusions from Babor et al. (2018) contrasts with the confidence indicated by Hughes et al. (2018) that penalties seem relatively unimportant. Before dismissing any impact of penalties upon use rates, we decided to revisit the penalty change events examined by Hughes et al. (2018), but to focus upon adolescents.

## Methods

### *Policy changes in Europe 2000 to 2014*

We sought to replicate the methodology of Hughes et al. (2018). The EMCDDA identified nine occasions where penalties regarding drug possession were altered in Europe since 2000, penalties increasing in three cases and decreasing in seven cases (EMCDDA, 2017; Hughes et al. 2018). They excluded Portugal as there was a lack of data on prevalence of adult use prior to the legislative changes in 2001. We sought to include Portugal. The policy changes were heterogeneous in nature and included measures such as reduction or removal of prison sentences, moves away from criminal convictions and towards administrative sanctions, changes to administrative sanction and increased efforts to

quickly close cases without formal sanction (EMCDDA, 2017; Benedetti et al. 2021).

### *Data source on past month cannabis use by 16-year-olds*

We used data from the ESPAD Survey (ESPAD Group, 2020). This survey has been occurring every four years since 1995, the most recent survey being in 2019. It is overseen by EMCDDA. Its purpose is to collect comparable data on the use of cigarettes, alcohol, illicit drugs, inhalants, new psychoactive substances and pharmaceuticals among 15–16-year-olds across Europe. About 700,000 students have participated in the seven successive ESPAD data collection waves thus providing the opportunity to analyse trends over the time period 1995–2019.

The ESPAD methodology has remained consistent over the study period. A questionnaire is self-completed by students in a school setting. The number of participating countries has increased over the years and 35 countries were included in 2019.

We opted to focus on the period eight years either side of the policy change, this providing the opportunity to include prevalence figures from two surveys either side of the policy change, providing four data points for each country. The source data on past month use for all countries was obtained from the latest ESPAD report (ESPAD Group, 2020). Where a data point was missing, we looked back at previous ESPAD reports to identify if a prevalence rate was recorded.

### *Analysis*

With limited data for each country, we planned to conduct a visual inspection of trends in keeping with the approach used by Hughes et al. (2018). There were insufficient data points to conduct any gold standard examination of change in the individual countries such as interrupted time-series analysis. Data points were anchored around the year of policy change (year zero) in each case.

### *Results*

Upon visual inspection, it appeared that many of the graphs were consistent with the anticipated deterrence effect. In order to provide some objectivity to these judgements, we then decided to fit a simple best-fitting linear trend line to the data for each country. The equation for the trend line gave a slope, which was either upwards (i.e. a positive slope) or downwards (a negative slope). This then allowed countries to be placed into a dichotomous category of either increased use or decreased use across the 16-year period around the policy change. We then compared the observed direction of the slope with that which would be predicted by a real deterrence effect. For example, a downward or negative slope following an increase in penalty would be consistent with a deterrence effect.

In six out of the seven instances where penalties were reduced, the trend line revealed an upward slope indicating increased use. In two out of three cases where penalties were increased, the slope was downwards indicating reduction in prevalence (see Table 1). Therefore, in eight out of ten cases, the slope of the trend line was consistent with deterrence theory.

We then used the principals of binomial distributions to determine how likely this was to happen by chance. For a single policy change, the odds of it being consistent with deterrence theory by chance are 0.5. Therefore, the likelihood that eight out of ten policy changes would coincide with a slope change consistent with deterrence theory by chance is  $56/1024 = 0.05$ . The two cases where the

**Table 1.** Past month cannabis use among 15-16 year olds before and after changes to penalties for personal drug use

Country	Year of change	Past month use prior to policy change (Mean %)	Past month use after policy change (Mean %)	% change in past month prevalence	Slope of trend line (change in prevalence per year)	Is slope Consistent with Deterrence Theory?
Penalty decreased						
Portugal	2001	3.8	6.65	75%	+0.30	Yes
UK	2004	18	11 <sup>a</sup>	-39%	-0.62	No
Italy	2014	12.7	14.9	17%	+0.17	Yes
Slovakia	2005	8.05	10.15	26%	+0.26	Yes
Bulgaria	2006	5.85	8.9	52%	+0.47	Yes
Finland	2001	1.6	2.35	47%	+0.09	Yes
Poland	2011	6.4	8.85	38%	+0.15	Yes
Penalty increased						
UK	2009	11 <sup>a</sup>	13 <sup>a</sup>	18%	+0.5	No
Italy	2005	13.7	12.7	-7%	-0.15	Yes
Denmark	2004	7.5	8.15	9%	-0.06	Yes

<sup>a</sup>Only one data point available for this time period.

trend was not consistent with the deterrence theory were both in the UK. To estimate the magnitude of change, either side of the policy change, we compared the average prevalence in the surveys prior to the policy change with the average in the ESPAD surveys after the change (see Table 1). Across all 10 events, the median change in the baseline prevalence was 21%, the largest increase (75%) occurring in Portugal.

If more conservative inclusion criteria are used requiring two prevalence data points on either side of the policy change, then eight events are included. UK policy flip-flopped within a 5-year period, initially becoming more liberal before reverting back to a stricter approach, and the UK has not participated in recent ESPAD surveys. In all eight cases with complete data, the findings are consistent with a deterrence effect ( $p = [0.5]^8 = 0.004$ ). Figure 1 presents the data points and trend lines from those eight events. The median trend change in the actual past month prevalence rate across those eight events moving from a stricter regime to a more lax regime, or vice versa, was 0.16% per year, or 1.6% per decade.

## Discussion

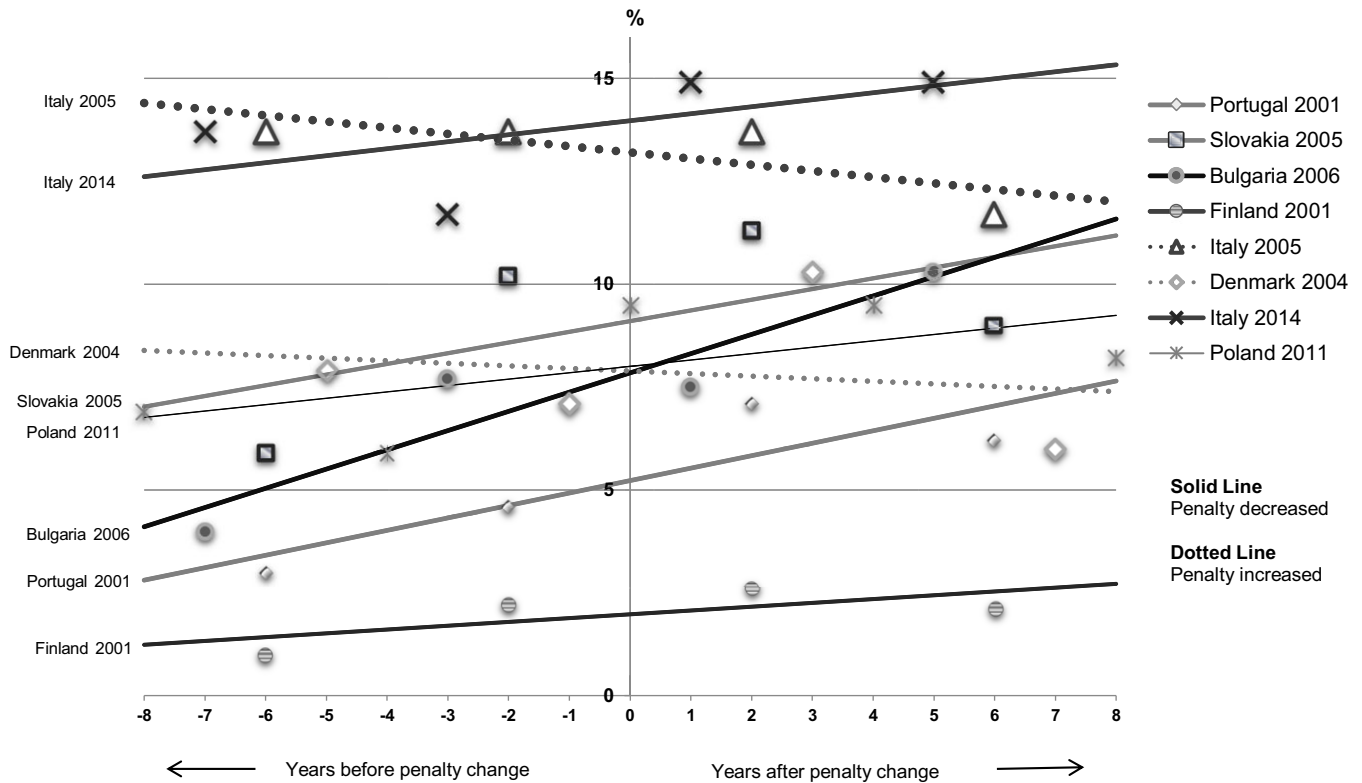
While our findings come with multiple caveats, they appear to challenge the view that penalties for personal drug use have no material deterrent effect upon cannabis use among European adolescents. The very simple trend analysis undertaken was consistent with a deterrence effect in every instance of policy change apart from the two legislative changes in the UK, which were made in quick succession permitting only one data point between the two changes. We had a full dataset for Poland, Portugal, Slovakia, Bulgaria, Finland, Denmark and both instances of policy change in Italy. In all eight of these cases of penalty amendments, the direction of change in adolescent cannabis use coincided with that which is predicted by deterrence theory. The range of countries included is culturally diverse.

There is a strong case that primary prevention initiatives should focus on adolescents. Key goals for all societies should be to minimise the proportion of adolescents who try cannabis and especially to limit the proportion of those who go on to use regularly (Di Forti et al. 2019; Volkow et al. 2014). Our analysis

focuses on past month use among 16-year-olds, indicating current use. This group constitute an extremely important group from a population health perspective, based upon the known hazards of adolescent cannabis use (Colizzi & Murray, 2018; Murray & Hall, 2020; Volkow et al. 2014; Wilson et al. 2019). There is emerging evidence that even minimal cannabis use around this vulnerable stage of brain development may result in measurable alterations in brain morphology (Orr et al. 2019; Albaugh et al. 2021). The trends found in this study suggested a possible 1.6% increase in the prevalence of monthly cannabis use over a decade. If this was to occur across Europe, it would mean an increase of 16,000 in the number of 16-year-olds using cannabis on a monthly basis. Even a small increase in prevalence carries risk of significant adverse public health impact given the large population involved (Smyth et al. 2020).

Our observations come with most of the methodological cautions already highlighted by others (Babor et al. 2018; Hughes et al. 2018). In reality, both the analysis by Hughes et al. (2018) and this study can be viewed as an examination of a case series of countries. Both studies have failed to use a control group of countries. Given the small number of countries available and the relatively small effect anticipated, it is very unlikely that use of control countries with this methodology would have adequate statistical power to detect impacts. The changes to penalty regimes were heterogeneous (EMCDDA, 2017). Unlike the examination of adult use by Hughes et al. (2018), a strength of our analysis is that it draws data from a single survey conducted consistently across Europe over a 24-year period (ESPAD Group, 2020). The inclusion of instances of increased penalties as well as penalty reductions constitutes a methodological strength.

Ideally, each country would have had multiple data points either side of the policy change to permit examination of slope and step changes. ESPAD generates estimates of population prevalence each of which has its own margin of error. Fitting a trend line is an unsophisticated method of determining a trend. Even in instances where we had four data points it is unlikely that the slope was significantly different to zero in any one case. There are also a multitude of social, cultural and economic factors which may influence rates of adolescent cannabis use over time (Babor et al. 2018).



**Figure 1.** Trend changes in past month cannabis use by 15–16-year-olds, eight years either side of changes to penalties for personal drug use.

Where penalty changes occur, the general public can often remain oblivious to these alterations (Babor et al. 2018). All of these methodological issues serve to increase the likelihood that a real but small deterrent effect would be missed in this and indeed in all other examinations of this issue.

If not a deterrent effect, it is difficult to explain the observed pattern of changes across these diverse European countries. Perhaps the societal discourse which occurs in and around revisions to penalties has an influence upon use, rather than the penalty per se. One advantage of use of trend line to explore change relates to fact that there is an increasing view that these policy changes are best viewed as a protracted process rather than as a singular event (Smyth & Cannon, 2021; Babor et al. 2018). As seen in Ireland during the course of the recent debate on decriminalisation, there tends to be a prolonged period of intensive discussion across media, prior to and following a policy change and this discourse may well also have an impact on use and non-use decisions by youth.

Researchers seem to agree that it is difficult to draw any real conclusions from the US data on this issue (Choo & Emery, 2017; Pacula & Sevigny, 2014). In a large Australian study, which has been assessed as having a very low risk of bias, it was found that prevalence of use increased by 12% from baseline after decriminalisation (Williams & Bretteville-Jensen, 2014). A recent attempted meta-analysis of this question determined that the current literature was too heterogeneous to permit statistical analysis (Melchior et al. 2019). A very recent European study, which utilised a difference-in-difference methodology, reported significant impacts of both relaxation and strengthening of drug laws upon adolescent cannabis use, these findings again being consistent with deterrence theory (Benedetti et al. 2021).

A limitation of our study and most other purported examinations of deterrence effects upon drug policies has been a focus limited to penalty severity, this being just one component of deterrence theory (Babor et al. 2018; Hughes et al. 2018; Watson et al. 2015). The three key elements of deterrence theory hypothesise that immediacy, certainty and severity of penalty are each important in deterring people from engaging in a penalised behaviour (Taxman & Piquero, 1998). A less severe penalty which is rapidly and reliably enforced may have more impact than a harsh penalty which is inconsistently and slowly enforced (Babor et al. 2018). Deterrence theory principals seem broadly accepted in other areas of public health such as efforts to reduce morbidity and mortality related to high-risk driving behaviours (Watson et al. 2015).

There is some evidence from other areas of legislative change that youth alter their attitudes and behaviour more rapidly than older adults (Kotsadam & Jakobsson, 2011; Svallfors, 2010). In that Norwegian example, younger people changed more in the conservative direction sought by the law change than older people. It was posited by the authors that “that those with fewer previous formative experiences in need of reconsideration are more prone to internalise legal norms”. A reduction of penalties for cannabis use may in theory lead to increased normalisation of use by more teenagers and greater use (Napper et al. 2016; Sznitman & Taubman, 2016).

The influence of legal factors upon drug use decisions has been demonstrated in students, who reported its criminalised status as a reason for avoiding use in separate Canadian, US and Irish studies (Hathaway et al. 2016; Martz et al. 2018; Byrne et al. 2022). An Australian survey found that the criminalisation of cannabis use was identified as a factor in decisions to avoid or reduce use, these impacts being more prominent in young frequent users

(Weatherburn et al. 2003). These studies suggest that some young people do factor aversive consequences into their drug use and non-use decisions. We do not know if these effects vary by gender or socio-economic group.

A significant challenge for public health science is the translation of evidence into political action and policy change in the real world. Public health advocates in domains such as tobacco control, alcohol-induced harm, gun-related injuries and road safety frequently argue for more robust legislation and greater criminal justice involvement (Babor et al. 2022; Mann & Michel, 2016; WHO, 2020). Efforts are made to persuade wary politicians and a sceptical public that laws, restrictions and penalties do indeed constitute effective tools as part of multifaceted responses to tackle harms. We were again reminded of the positive role of the criminal justice system in public health during the recent COVID pandemic where we witnessed use of legislative powers and An Garda Síochána to incentivise adherence to public health advice (Eustace et al. 2021). The international discourse around drug policy appears to stand alone in increasingly presenting arguments that laws and penalties matter very little in influencing healthy decision making.

Overall, we argue that it is premature to dismiss the impact of penalties upon adolescent cannabis use. The science is not settled yet. There remains a distinct possibility that a reduction or removal of penalties could contribute to increased use and this could in turn cause an increase in adolescent cannabis use disorders and cannabis-related health harms. Legislators should keep this in mind when contemplating alterations to penalties for personal drug use.

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**Conflicts of interest.** None.

**Ethical standards.** The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committee on human experimentation with the Helsinki Declaration of 1975, as revised in 2008. The authors assert that ethical approval for publication of this study was not required by their local Ethics Committee.

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